Remarks

The present invention is a process for converting C_{24} to C_{110} wax containing essentially no sulfur or nitrogen compounds, into an isoparaffinic lubricating oil base stock by first passing the wax and hydrogen over a unidimensional molecular sieve catalyst comprising a unidimensional intermediate pore molecular sieve with near circular pore structure having an average diameter of 0.50 nm to 0.65 nm, wherein the difference between a maximum diameter and a minimum diameter is ≤ 0.05 nm, and one or more Group VIII metals, to form an intermediate product and passing the intermediate product over a Beta catalyst comprising a zeolite Beta and one or more Group VIII metals, to form the isoparaffinic lube basestock having a pour point between -9°C and -54°C, a viscosity index (VI) between about 165 and 136, a kinematic viscosity at 100°C between about 6 and 5 cSt in a yield between about 59 and 20 wt% based on feed.

The Examiner rejects the claims under 35 USC §103(a) as obvious over Yen in view of Apelian.

The Examiner argues that Yen discloses a C_{10}+ feed stock containing paraffins, olefins, naphthenes, aromatics and heterocyclic compounds. Dewaxing conditions include a temperature between 450°F and 850°F, a pressure between 0 and 3000 psig, a LHSV between 0.1 and 10, a hydrogen to feedstock ratio between 500 and 8000 scf of H_2 per barrel of feed. Yen employs a catalyst comprising a medium pore crystalline silicate zeolite and a large pore crystalline silicate zeolite having a constraint index less than 2 and having hydroisomerization activity. The Examiner goes through a pore size description and effective pore size and constraint index description to indicate that the medium pore zeolites include ZSM-5, ZSM-11, ZSM-12, ZSM-23, ZSM-38, ZSM-35, ZSM-48, TMA offretite while the large pore zeolites include zeolite Beta, ZSM-4 etc.

The Examiner does acknowledge that in Yen the catalyst is employed as a mixture prepared by mulling together from about 5 to 60% by weight of the medium pore zeolite, about 5 to 60% by weight of the large pore zeolite and from 0 to about 50% by weight of a bender.

The Examiner points out that in Yen the final product has a pour point of 20°F (-6°C) as per Table 3, but that no viscosity index is recited for the "finished lubricant".

The Examiner argues that Apelian discloses the production of high VI lubricants by isomerizing petroleum waxes using a boron free zeolite with a high SiO_2/Al_2O_3 ratio (e.g., zeolite Beta). The waxes may be hydrocracked prior to isomerization while the isomerized product can be further dewaxed by either solvent dewaxing or catalytic dewaxing to achieve the target pour point. The Examiner goes into a review of alpha values for the catalyst as well as the presence of catalytically active Group VIII metal on the zeolite. The dewaxing catalysts are described as relatively constrained intermediate pore size zeolites (constraint index in the range of 1 to 12) which would include ZSM-22, ZSM-23 and ZSM-35. Catalytically active metal would also be present such as Pt or Pd. Apelian is further cited as teaching that the final product has a low pour point and low cloud point and high viscosity index and is recovered in excellent yield. VI values range from 130 to 150.

Applicants respectfully traverse the rejection.

Applicants must point out that Yen uses a mixture of catalysts to form a single mass, used as a single mass of catalyst to treat gas oil type feeds. While gas oil can be waxy, this is not the same as isomerizing a wax having hydrocarbons primarily within C_{24} to C_{110}. Yen dewaxes a waxy gas oil to produce gasoline and a dewaxed distillate. In Tables 1, 2 and 3 of Yen the product recovered in 65%, 90% or 73% yield is a 330°F+ product. This is a gas oil distillate product not a lube oil. When the Examiner

comments that Yen does not disclose the VI of his "lubricating oil" it is because Yen is not making a lubricating oil product. While Yen may indeed indicate that feed stocks reacted over a medium pore zeolite produce more gasoline than feed stock reacted over a large pore zeolite, the large pore zeolite producing more distillate, this is irrelevant with respect to the present invention which is not concerned with producing gasoline or dewaxed distillate but rather with the production of lubricating oil, lubricating oil being a product boiling in the 700°F+ range, a temperature more than double that of the dewaxed distillate of Yen (330°F+ product) (diesel type oil).

Nothing in Yen teaches, suggests or implies that lubricating oil can be produced in high yield with high VI and low pour point by converting a wax having hydrocarbons primarily within C_{24} to C_{110} over first an intermediate pore zeolite containing a Group VIII metal to produce an intermediate product which is then processed over a large pore zeolite B containing a Group VIII metal.

Merely because Yen teaches that by changing the ratio of intermediate pore zeolite to large pore zeolite in the mixed catalyst mass he is able to control the ratio of gasoline to distillate produced does not constitute a teaching or suggestion that a zeolite B catalyst and an intermediate pore size zeolite catalyst can be used in separate reaction zones to process a C_{24} to C_{110} wax nor in what order the zeolite should be used.

While Yen teaches a pour point of 20°F (-6°C) for presumably the 330°F+ product, this would be the pour point of a distillate fuel, e.g., diesel fuel.

In comparison, in the present invention the product is a lubricating oil base stock.

As shown in the Figures and in Table 1 of the present application, the lubricating oil product (700°F+ (371°C+)) lube is recovered in a yield between about 20 and 60 wt%, the product further having a pour point between -54°C and -9°C, a VI between

about 136 and 165 and a kinematic viscosity at 100°C between about 5 and 6 cSt. No product produced in Yen even remotely resembles this lube oil nor does anything in Yen suggest that such a lube oil can even be produced by Yen's process using a single catalyst mass, regardless of the ratio used.

In Apelian it is recited that waxy feeds is processed over a boron free low acidity zeolite hydroisomerization catalyst (e.g. zeolite B) and that this isomerate can be further dewaxed using solvent dewaxing or catalytic dewaxing. While feeds can be waxy feeds such as slack wax, deoiled wax, vacuum distillates derived from waxy crudes or even Fischer Tropsch waxes, Apelian is exemplified using hydrocracked slack wax processed over Pt/zeolite Beta, followed by solvent dewaxing. While Apelian may have recited that the partly dewaxed feed can be processed over an intermediate pore zeolite to produce a product of low pour point and low cloud point, and high VI, the product exemplified is one recovered in about 50-60% yield having a VI of about 146, a KV@100°C of about 5.5 cSt and a pour point of 0 to 15°F (-18 to -9°C) by zeolite B catalysis followed by solvent dewaxing. However, this product does not teach, suggest or imply the product of the present invention because reference to the data and Figures of the present application reveals that when in the present process a product of -9°C pour point is produced, the yield is almost 60%, the KV is 6 cSt, and the VI is 165. Thus, the product of the present invention has a higher VI and a higher kinematic viscosity at -9°C pour point than does the -9°C pour point product of Apelian. Comparing Apelian's -18°C pour point product with the -21°C pour point product produced in the present invention it is seen that, yet again, the product of the present process has a higher VI (about 160) than does the Apelian product as well as a higher kinematic viscosity.

In Apelian the lowest pour point reported is 0°F (-18°C). In the present invention, the product pour point goes down to -54°C while retaining high IV (about

136) and at a yield of about 20%. Nothing in Apelian taught or suggested that pour points on the order of -54°C could be attained while retaining high VI of about 136.

The section highlighted in Apelian (col. 14, lines 44 and 45) referring to an Example 6 and a Figure 4 teaching the effectiveness of employing ZSM-23 in combination with zeolite beta in an integrated system appears to be directed really to Example 5 and Figure 4 of USP 4,919,788 referenced at Col. 14, line 40 in Apelian.

USP 4,919,788 in Example 6 processes a severely hydrotreated waxy heavy neutral base stock in a 2 step scheme using Pt/zeolite Beta in the first stage and Ni/ZSM-5 in the second stage. Reviewing Table 9 in Example 6, the product produced in the 2 stage process exhibited a pour point of only 20°F (-7°C) and had a VI of only 97, in 67.8% yield.

In Example 5 of '788 a Minas gas oil was similarly processed in a 2 stage process over a Pt/zeolite Beta catalyst then over a Pt/ZSM-23 catalyst. The product had a reported pour point, depending on process condition severity, ranging from -5°C to -40°C but with VI of only 107 to 103. Reference to Figure 4 appears to be irrelevant because Figure 4 deals with the process of Example 3 in which a slack wax is subjected to successive Pt/zeolite Beta catalytic and MEK/Toluene solvent dewaxing. In Example 3 the product had a pour of only 20°F (-6.7°C) (Col. 26, line 1).

Clearly even '788 does not teach or suggest a process for producing lube base oils having a pour point between -9 and -54°C, corresponding VI's between 165 and 136, and corresponding kinematic viscosities between 6 and 5 cSt, the respective base oils being produced in yields between about 60 wt% and 20 wt% based on the waxy feed by processing a $C_{24} - C_{110}$ waxy feed first over a Group VIII metal loaded intermediate pore zeolite to produce an intermediate product which is then processed over a Group VIII metal loaded zeolite B catalyst.

Claim 1 has been amended to recite the pour points, VI's, kinematic viscosities and yields of products produced by the present process. These values are taken from the data presented in Table 1.

It is requested that the Examiner reconsider this application in light of the amendments made to the claims and the above remarks, that he withdraw the rejection, allow the claims and pass the case to issue in due course.

Respectfully submitted,

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